1942

Observations and studies on the peat deposits of Louisiana

William Rufus Dodson

LOUISIANA BULLETIN NO. 343. MAY, 1942

Observations and Studies on The Peat Deposits of Louisiana

By

W. R. DODSON

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATIONS

W. G. TAGGART, *Director*

OBSERVATIONS AND STUDIES ON THE PEAT DEPOSITS OF LOUISIANA

W. R. Dodson*

The fact that there are large deposits of peat in Louisiana has been known for some time but very little definite information has been available in regard to the extent or the depths of these deposits or to the kind or kinds of peat in the different ones. Besides the possible use of the peat in industry or in agriculture, there are many interesting problems in regard to the origin and nature of the deposits. Certain of these have for a considerable period held the interest of geologists, botanists, and soil technologists because the peats involved seemed to be different from most peat deposits.

Some years ago the writer became interested in the peat deposits of Iberia and St. Martin parishes. There the formations are found in the Grand Marais in the vicinity of New Iberia and Jeanerette and in an area surrounding Lake Tasse. The peat in these formations was found to have been formed mainly from plants that belong to the genus *Sagittaria*. While this genus is known to have a wide distribution in undrained lands, it does not appear that it has been reported previously as a dominant in peat formation. When a preliminary report on these studies was submitted to the Director of the Agricultural Experiment Station for publication, he requested that trips be made to other peat deposits of the State to determine their botanical origin and probable economic value.

From observations made on a few exploratory trips it became evident that the peat deposits of the extreme southern portion of Louisiana were very great. Publication of the first report on Iberia and St. Martin parish formations was deferred in the hope of developing a report for the entire State. Funds have not been available for making extensive surveys, but since the exigencies of war have stopped the importation of peat from European countries, and interest in the development of our own varieties of that product has increased, this report, though very incomplete, is now submitted for publication. It may be considered as a progress report and it is hoped that it may stimulate interest in the future development of surveys for the determination of full knowledge of our peat deposits.

This report is being presented in three sections: Section I, a discussion of peat, including its use and importance. Section II, a discussion of the

* The writer is greatly indebted for assistance in the preparation of this report to members of the staff of the Department of Botany, Bacteriology, and Plant Pathology, Louisiana State University; to Dr. C. W. Edgerton, Professor and Head of the Department, Dr. Lewis H. Flint, Professor of Botany, and Dr. Clair A. Brown, Associate Professor of Botany.

peat areas of South Louisiana. Section III, the Sagittaria peat of the Grand Marais and Lake Tasse areas.

SECTION I. PEAT, ITS IMPORTANCE AND USE

Commercial Importance of Peat

During the past several years the market demand for a good quality of peat for horticultural uses in the United States has exceeded supplies, and the imports have generally been greater than the domestic production. In 1939 the imports of peat moss for consumption in the United States amounted to 78,611 short tons, valued at ports of entry at $1,204,883.00. "Peat moss" is the trade name of the variety of peat that is formed from plant populations in which sphagnum moss predominates. The domestic production of all varieties of peat for the same year was 55,483 short tons, valued at $362,066 at point of production. Imports plus production therefore amounted to 134,094 tons, valued at $1,566,949. The domestic production for 1940 was increased to 70,097 tons, or 26 per cent; and in value to $516,865, or 43 per cent over 1939[1].

The British blockade of Germany has almost eliminated the item of peat moss from the list of articles imported into the United States because Germany, Netherlands, and Sweden were the sources of by far the greater part of our imports. In 1939 the imports from Germany were 28,127 tons, valued at $389,597. In 1940 the figures decreased to 41 tons valued at $340. Many orders for peat moss in that year were never filled. While the increased production of domestic peat moss and the use of other varieties of peat and of sugarcane bagasse from Louisiana have relieved the situation somewhat, there still seems to be an unusual opportunity to establish a much more extensive use of domestic peats in the United States. Many states have been using a relatively large amount of imported peat moss, and a supply of a satisfactory substitute of domestic origin would be welcomed. The extensive deposits of several varieties of peat in Louisiana may become an important natural resource if commercial uses can be found for them.

The following quotation from Joseph A. Corgan, author of the Chapter on Peat for the *Minerals Yearbook Review of 1940* is of interest: "The loss of foreign supplies of peat moss has doubtless inconvenienced former users of that product materially; on the other hand, it presents an opportunity for United States producers of moss peat to capture a share of this market."

Varieties of Peat

There are great differences in the characteristics of peats of different origin. These differences in color, texture, density, chemical composition, etc., largely determine their economic value. A specific variety of peat

[1] All the statistical data on peat production and imports not otherwise accredited are from *Minerals Yearbook Review* of 1940, United States Department of Interior, Bureau of Mines.

may be well suited for one purpose, while another variety might be preferred for another use. A variety of peat formed from forest vegetation would probably be superior to one formed from succulent plants if the product was to be used as fuel, while the appraisement of values would be reversed if the peat was to be used for soil improvement, or other uses in which the capacity to absorb liquids was a primary requisite.

The texture, density, combustible content, water absorption capacity, and some other qualities of peat are largely determined by the corresponding qualities of the plants that gave rise to it. These qualities are more or less closely correlated with the botanical classification of plants. Since the processes of decay and disintegration are arrested in peat before the cellulose structures are broken down, one may, generally, compare the structural elements of the peat with those of plants of known botanical classifications, and thus determine the names of the parent plants involved, or at least determine the genera to which they belong.

In general, the flora of a specific region may be very different from that of another region in another latitude and climate, and yet the environmental conditions in both regions may be favorable to peat formation. The resulting products would probably be as unlike in many respects as are the plant populations. The peat of Minnesota, where almost half the total peat resources of the United States are located, may be different from peat formed in Louisiana.

Uses of Peat and Muck

In some countries, especially in northern and northwestern Europe and the British Islands, peat is an important commercial commodity, used primarily for fuel, but to some extent for other purposes, including soil improvement, bedding for domestic animals, and packing material for storage and shipment of bulbs, nursery stock, fragile articles, etc. Some progress has been made in the utilization of some grades of peat in the manufacture of building ply-board, craft paper, insulating material, distillates, residual carbons, and other products. The possibilities of peat in industry are discussed in Bulletin 253, Bureau of Mines, U. S. Department of the Interior.

In this country, the principal use of peat in the past has been for improving the physical condition of soils that are used for horticultural and floricultural enterprises and for surface mulching of special plants in lawns, parks, and gardens. Some varieties are also used as absorbents of fluids and deodorization of floors of poultry plants and for bedding in animal cages and stables.

The possible use of peat in soil conservation should also be considered. Large sums of money are being paid to farmers from the public treasury as a subsidy for plowing under cultivated crops for soil improvement. It is not anticipated that this practice will go on indefinitely. Crops that could be used for hay have a money value as feed for livestock that would

exceed the cost of chemical fertilizer and peat that would give equal soil improvement. In 1933, A. P. Dachnowski-Stokes[2] voiced the sentiment entertained by many as follows: "The need of organic matter for soil improvement creates a problem that becomes increasingly acute. By far the most valuable constituent of a soil is the organic matter, and depletion of soil humus has become an important factor in impoverishing cultivated soils and subjecting them to erosion. The destruction and loss of soil organic matter by tilling, leaching, and other active agencies is taking place much more rapidly than it was accumulated. A deficiency in soil humus, already deplorable in long-established farming regions, cannot continue without imperiling the most vital resource of the nation.

"As a source of organic matter, the better grades of peat play a significant part in modifying the physical, chemical, and biological properties of mineral soils, and in making them more favorable for the growth of plants. Different kinds of peat are available in considerable quantities in the United States but are not uniform in composition and properties. The relative value of various peat materials in the preparation of desirable composts has been studied by many investigators. The value of peat in mixed fertilizer, or in composts with other plant residues and a variety of animal waste products has been recognized in older agricultural countries for many years."

There is a possibility that the plants growing on peat deposits may become an asset. Dense and luxurious crops of grasses, sedges, and other fibrous vegetation characterize many thousands of acres of peat lands in Louisiana. Such fibrous material may become important in the manufacture of paper and possibly other products.

Peat Deposits in the United States

In the early part of the present century there was a period of interest in the peat deposits of the United States as a reserve source of fuel. The United States Geological Survey, anticipating a prospective shortage of coal and wood, made partial surveys of the peat deposits and estimated the available amount of peat, calculated on an air-dried basis, as 12,888,500,000 tons[3]. About that time there was marked development in the production of petroleum, and interest in peat as a reserve source of fuel abated.

During the period near the close of World War I there was marked interest in peat in this country and in Canada, as well as in the countries of the eastern hemisphere, mainly because of the seeming possibility of developing practical ways of making a distillate from peat that would serve as a substitute for gasoline for airplanes in the war. There was a shortage of gasoline for this use. The Congress of the United States ap-

[2] Dachnowski-Stokes, A. P. Grades of peat and muck for soil improvement. U. S. Department of Agric. Circular 290. 1933.

[3] Davis, Charles A. United States Geological Survey, Bulletin 16. 1911.

propriated $100,000 and stipulated "that the Secretary of the Interior is hereby authorized and directed to make experiments and investigations, through the Bureau of Mines, of lignite coals and peat, to determine the commercial and economic practicability of their utilization in producing fuel oil, gasoline substitutes, ammonia, tar, solid fuels, gas for power, and other purposes." However, this act was not approved until February 25, 1919, the war having closed while the measure was under consideration by the Congress.

The officials of the Bureau of Mines were of the opinion that the sum appropriated was inadequate for proper research on both lignite and peat. On that account, investigation was directed to lignite, as this seemed to be more promising of results, and work on peat was deferred. Later, with a residue of the appropriation, the Bureau of Mines conducted laboratory experiments on peat and attempted to evaluate the results which had been obtained with peat in Canada and other countries. In 1926 a bulletin[4] was published which included a review of the progress made in both hemispheres.

So far as the writer is aware there has been no further specific appropriation of Congress for research along the lines begun under the appropriation of 1919. Conditions may again develop that will make it desirable to consider the value of our peat as a source of heat and power. In the future preparations for emergencies, it may be important to know where our peat deposits are, what kinds of materials are in them, and all other information about them that may be desired.

When the possibilities of securing distillates for war were considered, the United States Geological Survey undertook a more complete investigation of the possible peat resources of the United States and made surveys of most of the known extensive deposits of this country. These surveys increased the estimated total available peat of the United States to 13,827,000,000 tons. At that time it was not known that there were extensive peat deposits in Louisiana and very little consideration was given to the probability of there being enough in this State to materially alter this estimate. In a bulletin[5] published by the Geological Survey the following explanatory statement appears: "Peat occurs in a narrow belt of land along the coast of Alabama, Mississippi, Louisiana, and Texas, but so far as the writers are aware the deposits have not been examined." As this bulletin is probably the most used reference in regard to the occurrence and use of peat in the United States, it is regrettable that more complete information about the deposits in Louisiana was not available to the authors. The amount of peat in Louisiana is so large that it merits appraisement and consideration when the peat resources of the United States are again investigated.

---

[4] Odell, W. W., and O. P. Hood. Possibilities for the commercial utilization of peat. U. S. Department of Commerce, Bur. of Mines, Bulletin 253. 1926.

[5] Soper, E. K., and Osbon, C. C. The occurrence and uses of peat in the United States. U. S. Geological Survey, Department of Interior, Bulletin 728. 1922.

Recent Discoveries of Peat Deposits in Louisiana

Knowledge of the peat deposits in the southern portion of Louisiana has been greatly extended during the past 20 years. Dredging of commercial canals and drainage channels has uncovered peat deposits previously unknown. The discovery of rich petroleum reservoirs in many localities in the Gulf Coast territory of Louisiana has stimulated exploration of almost every nook of sea marsh in the State. Many localities were practically inaccessible until the development of "The Irrepressible Marsh Buggy," a motor-driven vehicle that combines some of the features of a farm tractor, a heavy duty motor truck, and a war tank. It has giant balloon rubber tires and is capable of riding down the dense vegetation that obstructs human penetration. It traverses soft terrain, crosses bodies of water on the buoyance of its tires, and travels at a rate of 8 to 12 miles per hour. While it was developed as a vehicle for traversing the marshes for oil explorations, its use has incidentally resulted in revealing the fact that in some portions of the territory whole groups of townships of land have a surface layer of peat. It would also be very valuable in locating the most favorable formations for development in case a market is found for Louisiana peat in commercial quantities.

SECTION II. PEAT DEPOSITS OF LOUISIANA

There are a number of districts in South Louisiana in which there are large areas covered with peat of some type. The information included in this bulletin in regard to these areas has been obtained by exploratory surveys and from men who have worked or lived in these areas. As these peat deposits form a resource in the State which has hardly been touched, it is hoped that some means will be found to continue the studies.

Peat of the Pontchartrain District

East of the Mississippi River and just north of the latitude of New Orleans are three lakes that form the major portion of the southern limits of a natural basin receiving the run-off from an area of approximately 25,000 square miles of territory in southwest Mississippi and southeast Louisiana. Named from west to east, the direction of their drainage, they are Lake Maurepas, Lake Pontchartrain, and Lake Borgne. The last named pours its water through two outlets into Mississippi Sound and several bays that open into Chandeleur Sound. It is more than a hundred miles from the open waters of the Gulf of Mexico to the west shoreline. With the exception of the north side and a short distance on the southwest side of Lake Pontchartrain, where well drained lands form the lake shore, all of these lakes are bordered by formations of peat and muck. The width of the formations varies from a few hundred feet at the narrowest places, to fifteen miles at the widest portions. The depth of formation ranges from one foot to 12 or more. In general, the formations back of the shorelines of Lake Maurepas and the west half of Lake

Pontchartrain have been formed from woody vegetation, the peat having been derived primarily from cypress (*Taxodium distichum* Rich.), sweet gum (*Liquidambar styraciflua* L.), sour gum (*Nyssa uniflora* Walt.), and tupelo gum (*Nyssa aquatica* L.).

In the region bordering the east half of Lake Pontchartrain and encircling Lake Borgne the formations are fibrous peat derived from saw grass (*Cladium effusum* (Sw.) Torr.), cat-tail (*Typha latifolia* L.), bull-rush (*Scirpus,* several species), sedge (*Carex,* several species), marsh grass or oyster grass (*Spartina,* two or more species—not determined), beef tongue (*Sagittaria lancifolia* L. and *S. latifolia* Willd.), wampee or pickerel weed (*Pontederia cordata* L.), paille finne grass or maiden cane (*Panicum hemitomum* Schultes) spider lily (*Hymenocallis sp.*), cut grass (*Zizaniopsis miliacea* [Michx] D, and A.), reed grass (*Phragmites communis* Trin.), and less important grasses, sedges, and rushes not determined.

Detailed soil surveys have been made of a part of this territory by the Bureau of Soils, U. S. D. A., in cooperation with the Louisiana Agricultural Experiment Station. These include the surveys of Tangipahoa Parish, Livingston Parish, and the New Orleans area.

In the Tangipahoa Parish survey[6] the northwest shoreline of Lake Pontchartrain is included. The area of peat reported was 59,200 acres. Most of this was in swamp land and the following quotations include the greater part of the description, which was written from the standpoint of soil appraisement and not with the thought of estimating the potential value of the peat.

> "For a depth of 3 feet or more, the material comprising the swamp is simply a brown peaty mass of decayed vegetation containing many root fibers and having a putrid odor. In certain parts of the swamp, a light drab clay was found underlying the peat at a depth of from 7 to 9 feet, but it lies usually much deeper than this. Most beds of the peat are covered with some standing water at all seasons of the year, and it is so nearly at sea level that during periods when a southeast wind blows the water from Lake Pontchartrain backs up along the bayous and overflows the lowlands to a depth of 2 to 3 feet. They are at all times boggy, and in some places, impassable."

Later in the report the following statement occurs: "Agriculturally, the peat has little value. The unstable character of the soil and subsoil is so nearly pure organic matter that only special crops could be grown upon it."

A sample of fibrous peat from the Tangipahoa area was obtained by the writer east of the Illinois Central Railroad tracks, approximately midway between Manchac and the north margin of the peat area. The location was about equally distant from the mouth of the Natalbany River to the west, and the mouth of the Chappepeela Creek on the east, and probably represented an area with the minimum amount of mineral

[6] Griffen, A. M., and Thomas A. Caine. Soil survey of Tangipahoa Parish, Louisiana. U. S. Department of Agriculture, Bureau of Soils. 1907.

sedimentation. The forest growth at this locality was scattered and paille finne grass (*Panicum hemitomum*) and *Sagittaria* (*S. latifolia*) constituted the prevailing plants. This peat sample was analysed by A. P. Kerr, Chemist of the Louisiana Agricultural Experiment Station, with the following results:

Analysis of Paille Finne and Sagittaria Peat

Ash	4.90 per cent
Volatile matter	94.10 per cent
Nitrogen	2.07 per cent

The ash content of this peat demonstrated that no appreciable mineral matter had been brought by sediment-carrying waters. The results corresponded closely with analyses of other fibrous peats in which *Sagittaria* was abundant (see later page of this bulletin).

Specimens of paille finne grass and *Sagittaria latifolia* were also analysed for a comparison with the peat. The paille finne grass showed 5.50 per cent ash, this being slightly lower than most recorded analyses of this plant. The Sagittaria plants showed the following ash content: petioles, 9.60 per cent; blades, 11.60 per cent; roots, 8.60 per cent; underground stems, 8.80 per cent.

Woody peat, which also occurs in Tangipahoa Parish, is mainly from cypress and sweet gum. Removing it from among the trees and stumps would be attended with much difficulty.

From areas near Lake Pontchartrain where there are open spaces, machinery for obtaining peat could probably be operated satisfactorily.

Livingston Parish is situated west of and adjacent to the south half of Tangipahoa Parish and Lake Maurepas. In the Soil Report of this parish[7] prepared by the Bureau of Chemistry and Soils, much information is included in regard to the large peat areas of this parish. The acreage of the different peat types is as follows:

Maurepas peat	23,296 acres	5.7 per cent of parish
Maurepas peat—marsh phase	192 acres	.1 per cent of parish
Barbary muck	22,336 acres	5.4 per cent of parish

Quoting from the report: "Maurepas peat is a slushy finely-disintegrated peat containing very little mineral material. It contains many roots and much partly decayed woody material. The underlying material is grayish-brown silty muck with a high mineral content, extending to a depth of 48 or more inches, where it passes into dark-drab clay. Maurepas peat appears to be woody peat largely derived from cypress. Its soft slushy character makes it hard to walk over. Roots of tupelo gum trees and cypress knees extend over the shallow water, and many rotting fallen

[7] Anderson, A. C., et al. Soil Survey of Livingston Parish, Louisiana. U. S. Department of Agriculture, Bureau of Chemistry and Soils. 1931.

logs are scattered over the surface." The map shows this formation covering a belt along the shore line of Lake Maurepas ranging from about a mile to five miles in width, and in six widely-separated areas surrounded by other soil types further inland. Quoting further: "The marsh phase of Maurepas peat includes areas of peat covered with grass and sedges instead of trees, and also includes small spots of open water. The trees and muck of the peat apparently have been burned off these open marsh areas. Large numbers of muskrats are trapped each year on the open marsh." The map shows this area one and a half miles west and a half mile south of the mouth of the Amite River. Nothing further is said regarding the identity of the grasses and sedges.

The reference to the abundance of muskrats suggests that the flora was probably cat-tails (*Typha angustifolia* and *T. pratens*), various sedges, sawgrass (*Cladium effusum*), and other vegetation common in territory a little further south where trapping is an extensive industry. The correlation of certain types of peat formation and muskrat population is discussed elsewhere. However, the area of this variety of peat is so small and so inaccessible that its importance is insignificant under present conditions.

The peat formations at several places where the peat and muck were supposed to be differentiated were examined by the writer, but no conspicuous difference in the two formations could be detected, unless it was in depth. Otherwise the descriptions quoted have been verified in a half dozen places. The slushy peat material constituted about two-thirds of the entire mass of material. Should any economic use for this kind of peat be discovered, some of the formations indicated as muck could also be used where the profile is deep enough to justify mining it.

In 1904 the Bureau of Soils published the results of a detailed survey of what was designated as the New Orleans Area[8]. It covered only the territory in the vicinity of the city and was intended primarily for the benefit of truck gardeners who sold their products locally. The following excerpt is taken from that report: "Between the Mississippi River and Lake Pontchartrain are extensive areas where the dense growth of vegetation has decayed and accumulated on the surface of the Sharkey clay to a depth from one foot to more than three feet. This more or less decomposed mass is made up of the trunks and leaves of trees, but more largely of the rank weeds and grasses of the locality."

A short distance beyond the limits of this survey there is an area of deep peat, covered with vegetation that is practically free of trees at the present time, except for occasional willows that have developed since reclamation work disturbed the natural terrain and the normal flora on the south side of the lake.

---

[8] Rice, Thomas D., and Lewis Griswold. Soil Survey of the New Orleans Area, Louisiana. U. S. Department of Agriculture, Bureau of Soils, 1904.

Deep peat was found in what was believed to be an obsolete river channel near the south margin of Lake Pontchartrain running west from West End as will be seen from the following excerpt taken from a letter from Mr. Allan T. Dusenbury, Consulting Engineer, New Orleans.

"Again in 1927, I had occasion to construct 10 miles of levee along the shore of Lake Pontchartrain in Jefferson Parish extending westward from West End.

"Soundings along the line of the contemplated levee disclosed peat varying in depth from 8′ to 18′ and in order to build a stable levee through this type of land a dredge boat canal was first excavated, the material from said canal being deposited on each side thereof, the space between being about 128′ in width. Hydraulic dredges were then utilized, taking sand and silt from the bed of Lake Pontchartrain about a half mile off shore and depositing it in the canal above referred to.

"Throughout the 10 mile stretch where the levee was constructed as above outlined, there probably was at least a half mile where the peat formation was 18′ in depth and a levee under these conditions could hardly have been constructed other than by the hydraulic method."

The peat here, in the few areas examined, was of the fibrous sedge-reed type. In 1913, Mr. W. G. Taggart, now Director of the State Experiment Stations, made a soil analysis of a sample taken near Little Woods, about 8 miles northwest of West End, on the south shore of Lake Pontchartrain, with the following results:

Organic and volatile matter	94.61 per cent
Insoluble matter	3.72 per cent
Iron and aluminum oxide	.10 per cent
Calcium oxide	.22 per cent
Magnesium oxide	.30 per cent
Sulphur trioxide	.16 per cent
Phos. pentoxide	.14 per cent
Sodium oxide	.64 per cent
Potassium oxide	.25 per cent
Insoluble silicon	.13 per cent
Moisture	46.20 per cent
Nitrogen	1.92 per cent

In order to secure some indication of the amount of sediment that had been deposited in that portion of the marsh that first received the overflow water from Chef Menteur in times of heavy rains, a composite sample was secured from the formation at a distance of approximately 200 feet from the bank of the Chef. The surface there was covered with a rank growth of *Phragmites,* growing to a height of 12 to 15 feet. Living roots and underground stems of the vegetation were discarded. The analysis gave results as follows: volatile matter, 61.5 per cent; ash, 38.45 per cent; nitrogen, 0.57 per cent.

Detailed soil surveys are not available for peat areas in the Pontchartrain district other than those mentioned above. From available maps, and from exploratory trips into the marshes, the writer has estimated that the total peat average in marsh lands in the Pontchartrain area not included in the 82,688 acres reported by the Bureau of Soils will approxi-

mate 100 square miles. It seems very conservative to assume that within this area there are 25 square miles that would have a peat profile of 4 feet of workable commercial peat. This would all be in open prairie, or land free of forest growth. While it may not be possible to work the peat in the timbered areas at the present time, the timber of the swamps should offer no greater obstacle to the utilization of the peat in this region than do the forest covers of many peat formations in other regions that are included in making an estimate of the total peat resources of the nation.

Three areas were located in which the peat was 12 feet or more in depth. Their areas were not determined. One area was located a short distance southeast of Little Woods; one near the north end of the Watson Williams Bridge; and one that was not explored but is said to run nearly parallel to Chef Menteur on the north side. An attempt was made to estimate the amount of peat in these deposits. Measured blocks of sedge-reed peat from the prairie-marsh land of this region were weighed, dried, measured and weighed again. These data showed that the lateral shrinkage was 33 1/3 per cent and the vertical shrinkage 25 per cent, or that the total volume shrinkage was 66 2/3 per cent.

These figures were approximate averages of several samples. The weights of the dried samples indicated that the peat from one cubic foot in the marsh would dry out to a weight of 6 to 8 pounds, being lighter when it had a large per cent of Sagittaria material. Eight pounds per cubic foot would represent a probable yield of 174 tons of dried material for each foot of depth of the profile, or 696 tons per acre. If we discount that to 600 tons per acre it would require only 3,333 acres to yield 2,000,000 tons. Six pounds per cubic foot would represent a probable yield of 130 tons per acre for each foot of the profile, or 520 tons per acre on a 4 foot profile. Discount this to 500 tons per acre, and 4,000 acres should produce 2,000,000 tons.

Estimates on weights per cubic foot check reasonably well with weights given for various varieties of peat as tabulated by A. P. Dachnowski-Stokes[9]. If it be assumed that there are 25 square miles of peat, with an average depth of 4 feet, in the prairie marshes of the lands bordering Lake Pontchartrain and Lake Borgne, and such index figures be applied, it would appear that this part of Louisiana is capable of producing 9,600,000 tons of air-dried peat. This is by far the smallest of the several peat regions that lie along the Gulf Coast region of the State.

Lake Salvador Peat District

Lake Salvador is a freshwater lake that is approximately 6 to 8 miles wide and 18 to 20 miles long, situated a few miles southwest of New Orleans. The long axis is northeast-southwest. It receives all the drainage water that flows from the area north of it between the natural levee on the west side of the Mississippi River and the natural levee on the east

[9] Dachnowski-Stokes, A. P. Grades of peat and muck for soil improvement. U.S.D.A. Circular 290. 1933.

side of Bayou Lafourche. The lake is bordered on the north, west, and south sides by peat formations that range from 5 to 7 feet in depth. An area of undetermined size on the central east side of the lake is 13 to 14 feet deep. Trappers familiar with the country have reported that the peat formation bordering the northwest shore extends northward 10 to 12 miles and available maps support these statements. West of the southwest end of the lake the peat area continues westward to within a mile or so of Bayou Lafourche, becoming gradually shallower. South of the lake the same general character of terrain extends about 30 miles (nearly to the Gulf of Mexico) with a width of about 12 miles. This is a general estimate made from maps and information gained from reliable people who have some personal knowledge of the country.

The writer's personal knowledge of the profiles of the formations and the character of the peat in them is limited to that secured in making soil auger borings during three days spent along the shoreline of the lake and in traversing two of the artificial canals leading from Bayou Lafourche into the deeper central part of the peat deposits. The extreme southern portion of the peat area was casually examined at a number of places between lower Lafourche and Grand Isle. At each observation point selected borings were made at distances from the banks of canals to give fair samples of the undisturbed formation, and at a distance from the shoreline of the lake, to avoid drift material at the lake margin. While the actual survey is little more than the examination of very small areas here and there, these spots are probably representative of the general formations that cover something like 300 square miles. If we discount this two-thirds and assume that 100 square miles have peat formations averaging 4 feet in depth and that one acre foot is capable of producing 150 tons of air-dry peat, the total available dried peat would be 38,400,000 tons. Most of this would be from mixed sedges, reeds, and grasses.

As one rides in a small boat in the lake or along the bayous and canals, it is not possible to see what kind of vegetation is to be found a few yards away. One must penetrate the marsh and get away from the material excavated from the canals and away from the drift material of the lake shore. It seems fairly safe to assume that general conclusions may be drawn from the data secured, at least the information gained will be helpful in planning more complete investigation. These conclusions are that vast quantities of sedge reed peats, cat-tail peat, sawgrass peat, and some fairly pure Sagittaria peat are to be found in this region. The more southern portion of the formations may be influenced by salt water, and possibly peat from such areas would be unsuited for some purposes.

The following excerpts from a letter from Mr. Allen T. Dusenbury regarding his experiences in a reclamation project about six miles southeast of LaFitte probably gives a fair picture of what may be encountered in a number of other places in the same region.

"During the past thirty years, as engineer, I have had charge of a large number of reclamation projects in the Parishes of Jefferson, St. Charles, Terrebonne, and Lafourche. In all of these projects levees had to be constructed through marsh lands where the peat or peaty muck ranged in depth from 2′ to as much as 18′ in depth. A fair average depth of peat might be considered 4′ but in most of the projects a portion of the levee system had to be constructed through areas where the peat formation was much greater.

"In Jefferson Parish on a project known as Jefferson Drainage District No. 3, there were a number of areas where the peat was very deep and to construct some of the levees, dredge boats had to pass over the work as many as seven times before the specified elevation was attained.

"In this district, also, when the field ditches were being excavated with a Buckeye Traction Ditcher, this machine, weighing about 25 tons, broke through the surface and buried itself about 14′, the peat at this point being probably over 14′ in depth. The area in which this ditcher sank was originally a small lake or lagoon which had filled up with decomposed vegetation, approximating the nature of true peat."

Complete chemical analyses of the peat in this area were not made. However, the rainfall that drains into this territory carries very little sediment as it does not run through territories where erosion occurs. Overflows from the banks of the Mississippi seem to have had little influence on the mineral content of the greater portion of the territory.

When one follows the excavated drainage and transportation channels between Lake Salvador and Bayou Lafourche, one finds several places where the spill banks have sloughed away, indicating that the dredged material included peat and that the excavated material was not sufficiently firm to stand up on the spill-bank. These old channels are generally from 4 to 8 feet deeper than the level of the mineral soil on their banks.

Lake Hatch and Lake de Cade Peat District

Terrebonne Parish no doubt has a very large peat area, though the writer has had little opportunity to study it. From information gained from trappers, game wardens, and engineers, extensive peat deposits were anticipated around Lake Hatch and Upper Lake de Cade, and north of Bayou de Cade. Starting from the end of the peninsula that projects into the marsh on Mandalay Plantation, the marsh was penetrated to an estimated distance of four or five miles. The peat near the margin was Phragmites, then paille finne,—almost a pure stand except for some areas of Sagittaria. At a distance of about two miles from shore the vegetation was so tall and dense that one could form no estimate of the kind of vegetation that might be found a short distance away. The volume of fibre that is produced annually on these peat lands is enormous. The plants observed were mainly *Spartina* and *Phragmites,* 10 to 15 feet in height. The peat was only about 3 feet deep, but increased in depth as the distance from shore increased. Finally an area of *Sagittaria* and some sedges and grasses was encountered. The depth of peat there was 4 feet or more.

Lake de Cade formation was examined on the shoreline at only one place, at which fibrous sedge reed peat was found. Other peat areas in Terrebonne Parish were not investigated.

Terrebonne Parish has a very valuable trapping industry, based mainly on the catch of muskrats. As noted elsewhere, the muskrat habitat in Louisiana is almost sure to be a peat formation. While not all peat areas are inhabited by muskrats, all good trapping land that the writer has known in this region is peat land.

White Lake—Grand Lake Peat District

White Lake and Grand Lake of southwest Louisiana are reputed to be surrounded by extensive areas of peat. The writer has had opportunity to examine only a small part of the margin of the general basin and a most interesting peat deposit designated by civil engineers as Latanier River. This peat deposit is the channel of an extinct or "drowned river" or bayou. Mr. F. E. Everett, Civil Engineer of the Southwest Land Company of Crowley, and of the Florence Land Company, Gueydan, has made a number of surveys that crossed this channel. He has estimated the length of the Latanier deposit as being approximately 20 miles. The central deep channel is flanked on both sides by peat 4 to 5 feet in depth. By the courtesy and assistance of Mr. A. L. Arpin of Gueydan, President of the Florence Land Company, and Mr. G. E. Welch, Manager of the Florence Club, who furnished the writer with a motor boat and guide, it was possible to make examinations at a depth of 19 feet in the Latanier deposit. It was the opinion of Mr. Welch that the deposit will average 21 feet in depth. No estimate could be made of the southern limits of the deposit, but it probably extends almost to the Gulf of Mexico. The following letter from Mr. Arpin is of interest.

"I have yours re. peat in the Florence District. The old Bayou is filled in to a depth of 30 ft. Years ago I had analyses made and found 3 per cent nitrogen on top and 5 per cent or better deeper down. Don't recall how deep I went . . . This stuff is hardly old enough to be classed as peat but deeper down it may be OK for fertilizer."

This formation, near the protection levee of the Florence Land Company, is mainly covered at the present time with paille finne grass and some *Sagittaria,* but the peat at this locality is probably 50 per cent Sagittaria. Samples were taken somewhat further west, where the depth was 19 feet, and submitted to Mr. Kerr for analysis.

A composite of numerous soil auger samples from 8 to 12 inches of the profile showed:

Ash	9.65 per cent
Volatile matter	90.35 per cent
Nitrogen	2.37 per cent

A sample taken at 19 feet showed:

Ash	11.30 per cent
Volatile matter	88.70 per cent
Nitrogen	1.90 per cent

The width of this basin was not determined at a sufficient number of places to give a proper index of its average area. At 4 miles west of Florence Club House it seemed to be 1000 or more feet wide. Only one day was available for examining this formation. It is highly probable that this formation, exclusive of the broad peat beds on both sides, should be capable of producing 3 to 5 million tons of air-dried peat.

Woody Peat of Washington Parish

Washington Parish occupies the extreme northeastern corner of the pine hill section of the Florida parishes. The Bogue Chitto River runs through the parish. It is a stream with a swift current and has evidently shifted its course at some places, abandoning segments of the former channel. Some of these areas have become filled with peat. Pearl River, a somewhat larger stream, which is the boundary between Louisiana and Mississippi, has also shifted portions of its stream bed, and peat and muck now fill some of the abandoned segments.

The Bureau of Soils of the U. S. Department of Agriculture made a detailed survey of this parish in 1922 and published the report in 1928.[10] In the table giving the areas of the different soil types, the total area of muck is stated to be 1,216 acres. Some of this muck is said to be underlaid with peat.

The formation that was selected by the writer for observation was located on the property of Mr. John Smith, 4 miles south of Franklinton. It was in the first bottom of Bogue Chitto River, and Mr. Smith said that it included 40 acres. The formation was muck at the margin, but at a short distance from the margin it was made up of undecomposed leaves, twigs, roots, and logs. Probably 30 to 50 per cent of the existing forest vegetation was slash pine and black gum. The dominant growth was shrubs, belonging to the family *Ericaceae,* or Heath family.

The peat had probably been modified to some extent by the leaves of pines, oaks, hickory, and other trees which had been washed down from the steep hillside west of the formation. The peat was black and odorless. The maximum depth of the formation was about 12 feet. In times of extreme flood of Bogue Chitto River the formation flooded, but the deposits of sediment were not heavy. A composite sample of peat from the best part of the formation showed 25% ash. This variety of peat could probably only be harvested at a cost greater than its market value. People living near it could probably afford to secure it for special uses, but there is no reason to believe it will have a commercial value.

Other Peat Areas

There are other peat areas in the State which are as yet little known. It may be recorded, however, that peat deposits are found north of the cheniers—long narrow strips of drained lands—that border the Gulf of

10 Anderson, A. C., et al. Soil Survey of Washington Parish, Louisiana. U. S. Department of Agriculture, Bureau of Chemistry and Soils. 1928.

Mexico in Cameron Parish. The writer traversed as much of this territory as could be reached by automobile road, making occasional trips northward on foot to the margin of the marsh land. In every such instance peat was found.

The peat deposits of Iberia and St. Martin are discussed in Section III.

SECTION III. THE SAGITTARIA PEAT OF THE GRAND MARAIS AND LAKE TASSE AREAS

In Iberia and St. Martin parishes there are two very interesting and important peat areas. One is the long and narrow area near New Iberia and Jeanerette known as the Grand Marais and the other is Lake Tasse, with the territory surrounding it.

The peat in these areas is of interest because it is decidedly dominated by the tissues and residues of plants that exhibit the characteristics of the genus *Sagittaria*. Plants of this genus are reported as appearing in the peat formations of Florida, and along the Atlantic coast as far north as Maine, but so far as the writer has learned, they have not previously been accredited as being a dominant in peat formation. This peat, therefore, apparently represents a new variety and is being given the name of the genus of plants that gives rise to it, Sagittaria peat.

Unusual Features of the Grand Marais Peat Formation

According to geologists[11] the Grand Marais is a bit of territory which once belonged to the alluvial plain of the Atchafalaya river. Gradually in this area a sediment bearing stream, which is now known as Bayou Teche, built up the natural levees which now confine it. This stream left the escarpment that marks the west boundary of the Atchafalaya basin at a point near the present city of New Iberia and encountered it again at a point near the present city of Jeanerette, leaving a basin about 10 miles long and a mile wide, the west half of which became a fresh water lake. This is the region which is now known as the Grand Marais. This area at present receives the run-off water of an area several times its size without any distinct drainage channel leading into it or out of it.

Gradually this fresh water lake became filled with Sagittaria peat and a bog was formed which ranged in depth from 1 to 6 feet. (Fig. 1)

Prior to the peat formation in the Grand Marais, a considerable portion of the land included in the basin was forested with cypress and gum trees. In some areas, stumps and logs now covered by peat are abundant and well-preserved. These have been exposed in drainage canals which have been dug. (Fig. 2)

Approximately at the middle period of peat formation in the Grand Marais, logs and combustible material on the southwest shore line were

[11] Howe, Henry W., and Cyril K. Moresi. Geology of Iberia Parish, Louisiana. Louisiana Department of Conservation. Geological Bulletin 1. 1931.

Fig. 1. Collecting peat samples from the Grand Marais formation.

burned, leaving ash and burned soil clearly marking the outline of trees and stump patterns. These later became covered with a new layer of peat.

In the Grand Marais, there are 2 parallel strips of mineral soil running through the peat area, about 100 feet apart and rising to an elevation of 4 or 5 feet above the level of the peat, then receding and becoming submerged in it, having a total length of more than half a mile. The strips of mineral soil really form two narrow islands in the peat formation. It is possible that these are the remnants of the natural levees of a stream that preceded the formation of Bayou Teche.

One of the interesting things about the Grand Marais is that the peat shows a very distinct line of cleavage separating the profile into two strata. None of the fibers of one layer penetrates into the other layer. The cleavage line is not at the same level in all parts of the bog. It is wavy, indicating that the peat from the upper stratum had settled down into depressions in the lower stratum. Nothing like this has been found in any other peat deposit in the State. This condition has not been explained satisfactorily, although several theories have been advanced. It is evident, however, that the explanations must be based on variations in the water level in the bog.

Unusual Features of Lake Tasse or Spanish Lake

Lake Tasse, or Spanish Lake, is a lake or basin located in Iberia and St. Martin parishes about $1\frac{1}{2}$ to 2 miles west of New Iberia and 6 to 7 miles from the Grand Marais. It lies between the west natural levee of

Fig. 2. Cypress stumps exposed in drainage canal in the Grand Marais.

Bayou Teche and the escarpment. It is quite similar to the terrain of Grand Marais except that there is an old channel opening into the basin that connects with the Vermilion river to the west and a semblance of a channel opening into Bayou Teche. There is a legend to the effect that at the time of the early settlement of the region by the French and Spanish, there was a direct water connection between Bayou Teche and Vermilion River through Lake Tasse. The Indians used this water course to travel by canoe from the Bayou Teche Valley to Lafayette.

At some time in the past, prior to written history, Lake Tasse covered about three times the area that it does at the present time. Vegetation encroached from the shoreline and gradually the more shallow portions became filled with peat. All of the old lake basin which is not now open water is covered with peat, most of which is of the Sagittaria type.

Also, a considerable portion of the bottom of the present lake is covered with a layer of peat. In general, this is approximately 2 to $2\frac{1}{2}$ feet in thickness at the margin and gradually diminishes toward the central portion of the lake. It extends 200 to 300 yards on the south side, for a greater distance on the east side, and for an undetermined distance from the north shoreline. This formation has been covered by water as far back as can be determined by old maps. The maps of 1812, made from the first surveys and secured at the State Land Office at Baton Rouge, show the south shoreline of the lake coming entirely up to the escarpment.

An unusual feature of the basin is the presence of a double peninsula which extends from the old shoreline on the east side and gradually disappears in the peat toward the central portion of the ancient lake.

Fig. 3. Dense growth of *Sagittaria latifolia* on peat deposit on the shoreline of Lake Tasse.

When the bottom portion of the profile of the peat formation at the north border was studied, it was observed that the mineral soil at the bottom was penetrated by many roots which indicated that the parent plants grew where the residues are now. However, at approximately two-thirds of the distance from the north side of the formation to the edge of the water of the present lake it was found that there was a fairly well defined differentiation between peat and mineral soil, with very little indication that the roots of the growing plants reached the mud at the bottom of the lake. Apparently the plant growth extended from the margin toward the center of the lake until the water was too deep to permit the normal growth of *Sagittaria* plants with the roots anchored in the soil. A floating mass then developed on the border. This mat eventually submerged, forming a layer of peat on the lake bottom. The portion not submerged became the present peat area bordering the lake. At the shoreline at the present time areas with a dense growth of *Sagittaria latifolia* occur (Fig. 3).

Distinctive Anatomical Characteristics of Sagittaria Plants and of Peat Derived from Them

At present *Sagittaria latifolia* is the most prevalent species of the genus where changes of drainage conditions have not taken place. This species should probably be considered an annual, though new growth comes from

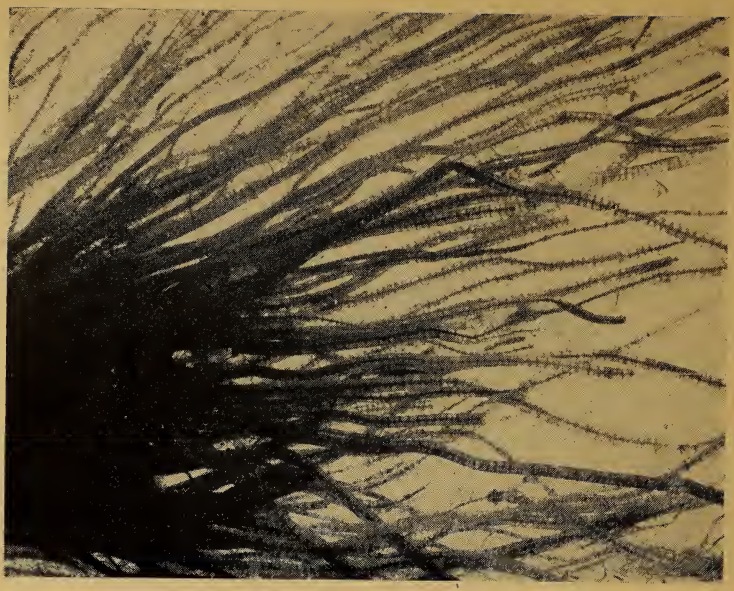

Fig. 4. Roots of *Sagittaria* showing the plate-like discs.

tubers. It may live through the winter if not frosted, but it is quite susceptible to frost and no specimens have been known to survive the winter at Spanish Lake, where the plant grows in abundance. Multiple primary roots are developed that grow to great length. Some may be found more than two feet below the surface. They do not branch, but many small fibrous roots come from the sides of the primary roots. The root consists of a central axis surrounded by plate-like structures extending to the epidermal layers which consist of two layers of thin-walled cells, generally rather transparent. Sometimes the plate-like structures are in the form of discs and sometimes they occur as spirals. Since the roots are generally about one-sixteenth of an inch in diameter, one can observe the general form of construction without the aid of a microscope (Figs. 4, 5). The discs or spiral turns are spaced at intervals about equal to the diameter of the root. The structure of the discs cannot be seen without the aid of a microscope. Their appearance is not easily described briefly, but may be shown in a reproduction of a photomicrograph. (Figs. 6, 7). The large basic cells are unusual. Extensions of the cell wall are formed like tubes. Each tube grows until it makes contact with a similar extension of the next neighboring cell. This creates a great number of intercellular spaces of irregular appearance. The spaces between the plate-like structures are filled with large, long, thin-walled cells that sometimes extend the full distance from one disc or spiral to the next one above it.

The peculiar cells in the plate-like structures in the cortex of the root are very characteristic of the genus *Sagittaria*. In studying peat, it is pos-

sible to identify *Sagittaria* by the presence of these cells. It is interesting to observe that Sachs, in his Textbook of Botany, published in 1882, illustrated these cells.

Analyses of Sagittaria latifolia

On account of the apparently large quantity of plant material on peat areas covered with *Sagittaria latifolia,* it seemed desirable to make a few analyses of this plant.

On June 8, 1937, single plants of *Sagittaria latifolia* were separated as to petioles, blades, and underground stems. Each lot was weighed, dried in an oven at 96 to 98° C., and reweighed. The following results were obtained:

Plant No. 1 young	*Gms. Fresh*	*Gms. Dry*	*Dry matter*
Petiole	67.37	4.85	7.2 per cent
Blade	25.70	1.63	6.3 per cent
Roots	23.20	1.80	7.7 per cent
Underground stems	14.24	.72	5.06 per cent
Plant No. 2 old			
Petiole	67.77	4.85	7.20 per cent
Blade	26.30	2.57	9.8 per cent
Roots	23.20	1.80	7.7 per cent
Underground stems	14.24 (?)	.72	5.06 per cent

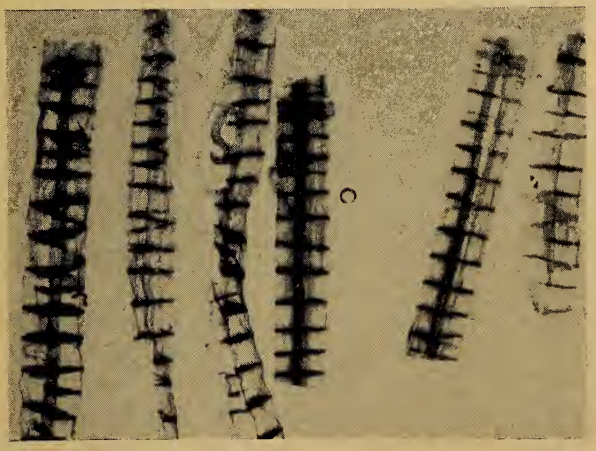

Fig. 5. Fibers of peat from the Grand Marais, showing the plate-like discs and spirals characteristic of *Sagittaria.*

On June 16, 1937, one square yard in a peat area was marked off and all living vegetation including the roots to a depth of 20 inches was removed. The material thus obtained was practically 100 per cent *Sagittaria latifolia*. This material was weighed, dried, and then reweighed with the following results:

Total weight before drying	2707 grams
Total weight after drying	250 grams
Dry matter	9.23 per cent
Total dry matter per acre	2500 pounds

A single plant of average size was carefully separated and the parts weighed, with the following results:

Petioles	170 grams	Underground stems	.87 gram
Blades	60.2 grams	Roots	52.00 grams

A feedstuff analysis of air dried material of the different parts of the plants was made by Mr. A. P. Kerr, with the following results:

	Crude Protein	*Fat*	*Nitrogen-free Extract*	*Fibre*	*Water*	*Ash*
Blades	22.50	4.80	35.10	17.80	8.20	11.60
Petioles	15.00	3.50	36.30	28.90	6.70	9.60
Roots	9.75	1.40	29.65	41.60	9.00	8.60
Underground stems	14.38	4.80	32.82	29.40	9.80	8.80

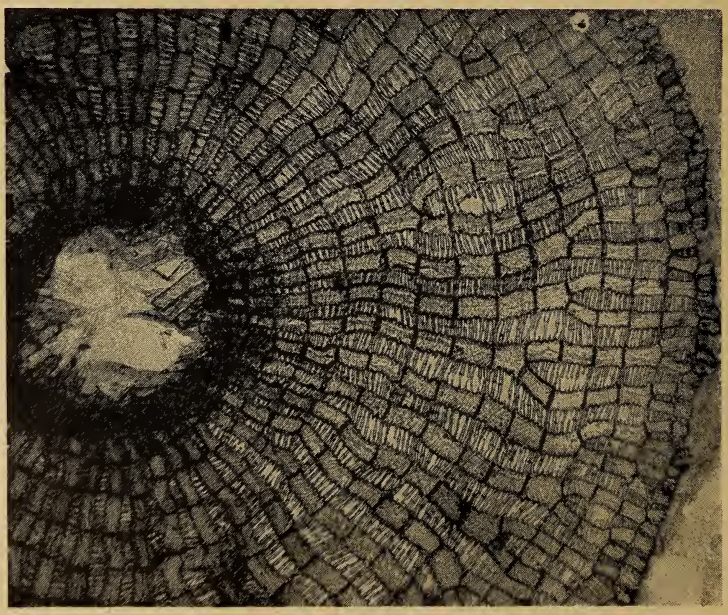

Fig. 6. A plate-like disc from root of *Sagittaria*.

Analyses of Sagittaria Peat

A few analyses were also made of samples of Sagittaria peat collected in the Grand Marais. The hydrogen-ion concentration averaged about pH 4.0.

The following chemical analyses were made by Mr. A. P. Kerr:

Per cent of volatile matter and ash in Grand Marais Peat

Depth	*Profile 1 Volatile matter*	*Ash*
4 inches	96.21	3.71
10 inches	95.69	4.37
16 inches	91.37	8.63
22 inches	24.68	75.32
	Profile 5	
4 inches	91.91	8.09
10 inches	93.86	6.14
16 inches	96.06	3.92
22 inches	69.05	30.95
31 inches	80.80	19.20

Fig. 7. Enlarged view of portion of disc-like structure in root of *Sagittaria* showing the peculiar characteristic cells.

Agricultural Analyses

Sample depth	*Percentage*			
	Nitrogen	*Phos. Acid*	*Potash*	*pH*
4 inches	2.07	.12	.08	4
12 inches	2.74	.10	.08	4
18 inches	2.20	.09	.07	4.60
30 inches	.70	.08	.06	5.30

The acidity of the Grand Marais peat is about what is recommended for azaleas and camellias. While the profile is rather shallow, this should not prevent working the formation to a depth of about two feet if there is demand for the peat.

Shrinkage of Sagittaria Peat Upon Drying

A number of tests were made on the shrinkage of Sagittaria peat when taken from the marsh and air dried. The general conclusion reached was that the peat from Spanish Lake formation, where the land has not been pastured, shrinks 1/4 in vertical dimension and 1/3 in lateral dimension so that a cubic foot extracted in saturated condition would shrink on drying to 9 inches in vertical dimension and 8 inches in the lateral dimension or an actual shrinkage of 2/3 of the volume.

As a result of tests made on a number of blocks of peat measuring 2x3x3 inches, it was determined that a cubic foot of peat in the bog saturated with water would weigh about 70 pounds. Upon drying to the air-dried condition this weight decreases to about 8 to 10 pounds. This would represent a possible production per foot of depth of 174-217 tons of air-dried peat.

It was also determined that Sagittaria peat, when dried beyond a certain point, would not again absorb sufficient water to bring it back to the original weight.

In April, 1938, 5 cubes of peat from Spanish Lake taken near the bottom of a profile of a good peat section were cut and trimmed to a weight of 50 grams each. These samples were placed in the attic of the South Agricultural Building on the Louisiana State University campus and allowed to dry for a year, when they were again weighed. These samples were then immersed in water to test the capacity of reabsorption. The following results were obtained:

	Dried weight grams	*Weight after resaturation grams*
No. 1	4.85	18.70
No. 2	4.65	17.50
No. 3	4.87	18.30
No. 4	4.65	15.00
No. 5	4.86	20.20
Average	4.77	17.94

In another test a sample of 1000 grams of mixed Sagittaria peat from Spanish Lake and Grand Marais was dried to a weight of 300 grams. When resaturated the material again weighed 1000 grams. A similar sample reduced to a dry weight of 250 grams weighed only 600 grams when immersed in water. This showed that at some point between 30 per cent moisture and 25 per cent moisture there was a marked change in the absorptive capacity of the peat.

Samples from Grand Marais and Spanish Lake, when heated to 96° C.-98° C. would no longer regain their spongy texture and former weight when immersed in water for a prolonged period.

SUMMARY

1. Large amounts of peat are used annually in the United States for various purposes. Formerly a rather considerable percentage of this material was imported from Europe. At the present time, on account of war conditions, importations of peat have been practically eliminated.

2. Peat from the United States which is used in agriculture and in industry comes largely from peatmoss bogs located in the northern states.

3. That there are considerable areas of peat in Louisiana has been known for some time, yet there have been but few attempts to determine the extent of the peat deposits or the nature and the possible uses for the peat.

4. It has been possible in recent years to make some surveys over the peat areas of South Louisiana and to study in some detail one of the more interesting deposits.

5. Very large peat deposits were found in the vicinity of the various lakes, including Lake Pontchartrain, Lake Salvador, Lake Hatch, White Lake, Grand Lake, and Lake Tasse. The combined area of these deposits is several hundred square miles.

6. The peat in these areas consists of partly disintegrated parts of various plants such as reeds, grasses, sedges, woody plants, and various other aquatic plants. Sphagnum moss, which is common in many northern peat bogs, is not a common constituent of Louisiana peat deposits.

7. An interesting type of peat which apparently has not previously been described is given the name of Sagittaria peat. In this the dominant material consists of partially disintegrated roots of plants of the genus *Sagittaria*.

8. Large areas of Sagittaria peat occur in the Grand Marais and in the vicinity of Lake Tasse. The unusual features of the Sagittaria peat deposits are described in some detail.